



PREDACIDES

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INTRODUCTION

Predacides are lethal agents that remove offending predators, and their use is the one of several techniques of an integrated program for control of predation (1, 2). The use of predacides in the United States is a controversial issue for livestock producers, resource managers, biologists, and the general public. Historically, the predominant application of predacides has been for the control of mammalian carnivores such as red foxes (*Vulpes vulpes*), coyotes (*Canis latrans*), and wolves (*C. lupus*) that prey on livestock and poultry. Currently, there are no predacides for wolves because they are endangered in most of the United States. In addition to their use for reducing predation on livestock, predacides have been used in conservation programs for control of predators and other animals such as exotic invasive species that prey upon federally designated threatened or endangered species, or are vectors of communicable disease. Four predicide products are registered by the United States Environmental Protection Agency (EPA) (Table 1) for mammalian predator control and each has stringent regulations and directions for use. Three products have specific use restrictions and are classified as Restricted Use Pesticides, requiring that applicators be trained and certified. The use of any predicide must conform to all applicable federal, state, and local laws and regulations. Taking only offending animals that cause predation is a major goal in lethal predator management and is accomplished through the use of specific delivery systems and placement of predacides. Through unique delivery devices and restrictive requirements on their use, exposure of the predicide in the environment and to nontargets is reduced.

PREDACIDE FOR DEPREDATING COYOTES

One of the most selective techniques for depredating coyotes is the sodium fluoroacetate (Compound 1080) Livestock Protection Collar (3, 4). The Livestock Protection Collar is a Restricted Use Pesticide for use on sheep

or goats and takes advantage of the coyote's attack behavior of biting on the throat to kill the animal. The distinct advantage of using the collar is that only the coyote that is actually killing the sheep or goat is affected; coyotes that may not be killing livestock are unaffected. The collar has two rubber reservoirs containing a solution of sodium fluoroacetate and is attached on the throat of a sheep or goat with straps around the neck. A coyote that attacks the throat of a collared animal bites into the reservoir and receives an oral lethal dose of sodium fluoroacetate. Sodium fluoroacetate is highly toxic (5) and strict state and federal regulatory requirements, and 18 use restrictions govern its use in the collar. One restriction limits use of collars in fenced pastures only; collars cannot be used on open range. Training and certification of applicators is required on a state-by-state basis and currently seven states have EPA-approved programs. Although the collar has high selectivity, it has not been widely used because of the high level of management resources required to direct the coyote's attack to the collared livestock. To be most effective the collar must be used with specific sheep and goat husbandry practices where predation is high and regular. The usual procedure is to place collars on a small group of penned animals from a flock and move the other livestock to another vicinity.

FUMIGANT FOR DENS

The Large Gas Cartridge is a fumigant for control of coyotes, red foxes, and striped skunks (*Mephitis mephitis*) in dens only and is not a Restricted Use Pesticide. The active ingredients in gas cartridges, sodium nitrate and charcoal, produce carbon monoxide when ignited (6). The gas cartridge is also very selective because the dens of the target animals can be identified by size, tracks, remains of prey, scat, and observation of animals at the site. Coyote and fox predation on livestock is high during the spring of the year and gas cartridges are used primarily at this time when the adults are providing food for their young. The biological basis for fumigating dens was demonstrated in

**Table 1** Predacides registered by the United States Environmental Protection Agency (Registrant for these predacides is the U.S. Department of Agriculture, Animal, and Plant Health Inspection Service.)

Product label name/EPA registration number	Active ingredient(s)	Target species
^a Sodium fluoroacetate (Compound 1080) livestock protection collar/56228-22	Sodium fluoroacetate	Coyote
^b Large gas cartridge/56228-21	Sodium nitrate, charcoal	Coyote, red fox, striped skunk
^a M-44 Cyanide Capsules/56228-15	Sodium cyanide	Coyote, red fox, gray fox, wild dog
^a M-44 Cyanide Capsules/56228-32	Sodium cyanide	Arctic fox

^aRestricted use pesticide^bGeneral use pesticide

a study that showed that killing of sheep by coyotes was sharply reduced when the pups in dens were removed (7). Sheep kills were reduced by 92% when pups were eliminated, 99% when both pups and adults were removed, and only 4% when no removal was conducted, suggesting that provisioning pups motivates the killing of larger prey animals. Dens may be treated if skunks are creating health and safety hazards (i.e., rabid animals) or are depredating threatened or endangered species.

CYANIDE EJECTOR DEVICE

M-44 Cyanide Capsules is another Restricted Use Pesticide; it has 26 use restrictions and requires that applicators be trained and certified. The M-44 has two product labels. One label is for controlling coyotes, red foxes, gray foxes (*Urocyon cinereoargenteus*), and wild dogs (*Canis familiaris*) that prey upon livestock and poultry, threatened or endangered species, or are vectors of communicable disease. The principal use is for coyote damage management in pastures, rangeland, and forest land (8). The other label is for control of arctic foxes (*Alopex lagopus*) that depredate threatened or endangered species in the Aleutian Islands, Alaska. The M-44 ejector is a spring-powered device that consists of an ejector mechanism, a base that is placed in the ground to contain the ejector, capsule holder, and capsule containing sodium cyanide. The capsule holder is wrapped with absorbent material that contains a lure bait and protrudes above the ground when set. The ejector is triggered when a canid pulls hard on the baited M-44 unit and sodium cyanide is ejected into the animal's mouth; smaller animals cannot activate the device. Moisture in the animal's mouth reacts rapidly with sodium cyanide releasing hydrogen cyanide gas and the animal succumbs within a few seconds. When M-44s are placed in the field, applicators use their expertise in animal

behavioral patterns to minimize the risk of attracting nontarget animals to the device. The risk to nontarget animals is also reduced through the use of specialized lures and attractants designed for the species of concern.

FUTURE PROSPECTS

In recent years, public attitudes have not supported techniques of lethal control of carnivores and with increased regulations, the use of predacides for depredation management will most likely be reduced as reliable efficacious nonlethal techniques are developed. Several nonlethal control methods such as frightening devices (e.g., lights, sirens, pyrotechnics) and guard animals such as dogs, llamas, and donkeys have had various degrees of success in reducing predation in some situations but are not practical for all livestock husbandry situations. It is appealing to think that repellents or substances that produce conditioned taste aversion could be developed to deter predation, but investigations to date have not shown much promise (9). Fertility control, with the presumption that reductions in numbers of offspring would result in less livestock predation, is a promising area of investigation that is receiving renewed attention (10). However, a useable product, if successful, will still take years of development.

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